

SCIENCE RESOURCES¹

EVIDENCE SOURCES

Early Childhood Science Education <http://www.nsta.org/about/positions/earlychildhood.aspx> (3-5)

This position from the National Science Teachers Association delineates why teaching science in the early years is important.

Early STEM Matters: Providing High-Quality STEM Experiences for All Young Learners (3-9)

<https://50.erikson.edu/wp-content/uploads/2017/01/STEM-Working-Group-Report.pdf>

This January 2017 report offers guidance around the development and improvement of effective early childhood science, technology, engineering, and math (STEM) education policies and practices. It describes four guiding principles related to early childhood STEM education and six actionable recommendations for educational leaders, researchers, funders, and policymakers at the local, state, and federal levels.

Math and Science in Preschool: Policies and Practice (3-5)

<http://nieer.org/wp-content/uploads/2016/08/MathSciencePolicyBrief0309.pdf>

This report addresses the development of mathematics and science understanding in preschool children, reviews the current knowledge base on educational practices in these domains, identifies areas that require further study, and outlines recommendations for early education policy in mathematics and science.

Math, Science, and Technology in the Early Grades (3-6)

http://www.futureofchildren.org/sites/futureofchildren/files/resource-links/starting_early_26_2_full_journal.pdf

This chapter from Fall 2016 issue of The Future of Children highlights the many ways in which young children frequently ask scientific questions, such as why questions. They highlight how teaching science will contribute broadly to cognitive development, and offer successful programs for doing so. They also discuss barriers to STEM teaching in preschool.

National Science Education Standards (3-9) <http://www.nap.edu/readingroom/books/nse/>

The National Science Education Standards are premised on a conviction that all students deserve and must have the opportunity to become scientifically literate. The Standards describe a vision of the scientifically literate person and present criteria for science education that will allow that vision to become reality.

Next Generation Science Standards <http://www.nextgenscience.org/get-to-know> (5-9)

The Next Generation Science Standards (NGSS) are K–12 science content standards that were developed by states to improve science education for all students. These standards were created to give local educators the flexibility to design classroom learning experiences that stimulate students' interests in science and prepares them for college, careers, and citizenship.

¹ This collection was compiled and annotated by [Camille Catlett](#) for the Vermont Agency of Education and funded by the Vermont Race to the Top Early Learning Challenge Grant. It is current as of September 2017. **Highlighted resources are available in English and Spanish.**

Science Achievement Gaps Begin Early and Linger (0-5)

<http://www.aera.net/Newsroom/NewsReleasesandStatements/ScienceAchievementGapsBeginbyKindergarten/ScienceAchievementGapsBeginVeryEarly.Persist,andAreLargelyExplainedbyModifiableFactors/tabid/16214/Default.aspx>

A January/February 2016 article in Educational Researcher shares that the strongest contributors to science achievement gaps in the United States are general knowledge gaps that are already present at kindergarten entry. The article goes on to discuss the implications of this research.

STEM Starts Early: Grounding Science, Technology, Engineering, and Math Education in Early Childhood

http://www.joanganzcooneycenter.org/wp-content/uploads/2017/01/jgcc_stemstartsearly_final.pdf (report)

http://www.joanganzcooneycenter.org/wp-content/uploads/2017/01/jgcc_stemstartsearly_execsum_final-1.pdf (executive summary)

Tomorrow's inventors and scientists are today's curious young children—as long as those children are given ample chances to explore and are guided by adults equipped to support them. STEM Starts Early is the culmination of a deep inquiry supported by the National Science Foundation that aims to better understand the challenges to and opportunities in STEM learning as documented in a review of early childhood education research, policy, and practice and encourages collaboration between pivotal sectors to implement and sustain needed changes. The report features research by the FrameWorks Institute on some common misconceptions around early STEM learning, and how reframing the conversation can help the public overcome these often-problematic ways of thinking, leading to a greater understanding of the importance of prioritizing and investing in STEM learning opportunities for all children. STEM Starts Early provides key recommendations for education leaders, researchers, and policymakers across the country to improve opportunities for children to become confident learners in science, technology, engineering and math.

PRINT SOURCES

Beyond Bouncing the Ball: Toddlers and Teachers Investigate Physics (1-2)

<https://www.naeyc.org/resources/pubs/yc/jul2016/beyond-bouncing-ball-toddlers-and-teachers-investigate-physics>

This article highlights the journey of two teacher researchers who joined with the authors (who are early childhood job-embedded professional development facilitators, supporting professional learning alongside early childhood educators as they work with children) to explore a process of inquiry to strengthen their knowledge about children and about science.

Childhood in the Garden: A Place to Encounter Natural and Social Diversity (3-5)

<https://eclkc.ohs.acf.hhs.gov/learning-environments/article/childhood-garden-place-encounter-natural-social-diversity>

This article explores the important role of the garden in children's learning. A teacher educator/center director and a preschool teacher share images and ideas that frame their adventures in the garden with children and draw from their broader goals for children—about who they are and how they learn about their world.

Community-Based Engineering STEM Experiences from a Second Grade Urban Classroom (6-9)

<https://www.naeyc.org/resources/pubs/yc/nov2016/engineering-second-grade>

The instructional approach described in this article (Community-Based Engineering or CBE) uses engineering design to create authentic learning experiences for young children in urban classrooms. The applications described in the article could easily be modified for use with elementary students in grades 1 through 5.

Dialogue on Early Childhood Science, Mathematics, and Technology Education (3-9)

<http://www.project2061.org/publications/earlychild/online/>

Looking for a great collection of downloadable articles on early childhood STEM education? This is it. While these resources compiled by the American Association for the Advancement of Science are not brand new they offer interesting perspectives, ranging from science in the classroom to equity in access to STEM content.

From Static to Circuits: Inquiry-Based STEM Explorations of Electricity (3-4)

<https://www.naeyc.org/resources/pubs/yc/jul2017/static-circuits-explorations>

The author shares examples of guiding inquiry about electricity in classrooms of 3- and 4-year-olds—but these ideas can be implemented with older children as well. She also explains approaches for engaging students in inquiry-based scientific, technological, engineering, and mathematical (STEM) experiences.

Infants and Toddlers Meet the Natural World

<http://www.naeyc.org/files/yc/file/200801/BTJNatureMcHenry.pdf>

(0-3) *Through this article you'll learn about ways to help children observe, listen, feel, taste, and take apart while exploring everything in their environment. They describe how teachers can cultivate nature investigations with very young children by offering infants natural objects they can explore and investigate.*

Kids in STEM (3-6)

<http://www.communityplaythings.com/resources/articles/2019/kids-in-stem>

The spirit of curiosity and experimentation, which is the heart of science, technology, engineering, and math, is deeply embedded in the natural play of young children. Providing time and materials for this sort of play and discovery can be an effective way to inspire the world's future innovators. This article shares ways to do this, along with additional free resources upon which to draw.

Let's Talk, Read, and Sing About STEM: Tips for Preschool Teachers and Providers (3-5)

<http://www2.ed.gov/about/inits/ed/earlylearning/talk-read-sing/stem-toolkit-preschool-teachers.pdf>
(English)

<http://www2.ed.gov/about/inits/ed/earlylearning/talk-read-sing/stem-toolkit-preschool-teachers-es.pdf>
(Spanish)

Here are some tips for using daily routines to build math and science concepts and skills through play and exploration.

Promoting the Development of Scientific Thinking (3-5)

http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleId=409

This article discusses the benefits of active, hands-on learning, goals for early childhood science programs, and suggestions for fostering scientific learning in the early childhood classroom.

Reading an Object: Developing Effective Scientific Inquiry Using Student Questions (5-7)

<http://earlymath.erikson.edu/wp-content/uploads/2014/04/ReadingAnObject.pdf>

This article discusses the power of allowing students to construct their own conceptual understanding as they “read an object” in a series of guided inquiry steps, developing their own questions about the object.

The Roots of STEM Success: Changing Early Learning Experiences to Build Lifelong Thinking Skills (0-9)

http://centerforchildhoodcreativity.org/wp-content/uploads/sites/2/2018/02/CCC_The_Roots_of_STEM_Early_Learning.pdf

This 2018 report from The Center for Childhood Creativity reviewed more than 150 studies and found that young children are capable of developing complex thinking skills before they are able to speak. The report is organized by six research-backed findings, one of which is that children need more play to become strong STEM thinkers (pages 12-16). Practical tips in each section make this a useful resource for families and professionals.

Science at the Center of the Integrated Curriculum: 10 Benefits Noted by Head Start Teachers (3-5)

<http://www.naeyc.org/files/yc/file/200209/ScienceAtTheCenterOfTheIntegratedClassroom.pdf>

This list shares ten kinds of benefits the teachers have noticed as a result of providing an intentional emphasis on science.

Science Concepts Young Children Learn Through Water Play (3-5)

http://www.southernearlychildhood.org/upload/pdf/Science_Concepts_Young_Children_Learn_Through_Water_Play_Carol_M_Gross.pdf

This article identifies the science concepts involved in a variety of water play activities and the teacher-mediated learning process that can accompany and enhance this learning.

Science in Early Childhood Classrooms: Content and Process (3-9)

<http://ecrp.uiuc.edu/beyond/seed/worth.html>

This paper addresses the question of what the nature of science teaching and learning in the early childhood classroom should be. It proposes four basic ideas: (1) doing science is a natural and critical part of children's early learning; (2) children's curiosity about the natural world is a powerful catalyst for their work and play; (3) with the appropriate guidance, this natural curiosity and need to make sense of the world become the foundation for beginning to use skills of inquiry to explore basic phenomena and materials of the world surrounding children; and (4) this early science exploration can be a rich context in which children can use and develop other important skills, including working with one another, basic large- and small-motor control, language, and early mathematical understanding. It describes a structure for learning through inquiry and criteria for the selection of appropriate content for young children. It concludes with implications for the classroom, focusing on child-centered curriculum, the role of materials, the use of time and space, the key role of discussion and representation, and the teacher's role.

Science in the Preschool Classroom: Capitalizing on Children's Fascination with the Everyday World to Foster Language and Literacy Development (3-5)

<http://www.mothernaturespreschool.ca/pdf/ScienceInThePreschoolClassroom.pdf>

This article highlights opportunities within a science-based curriculum to support language and literacy development by capitalizing on the interests and problem solving of the children.

STEM Resources and Materials for Engaging Learning Experiences (3-9)

<https://www.naeyc.org/resources/pubs/yc/mar2017/stem-materials-experiences>

The STEM experiences teachers provide for young children can involve a variety of learning materials, including children's literature, consumables and manipulatives, and web-based resources. This March 2017 article offers suggestions and examples to guide teachers' selection of classroom STEM resources and materials.

Supporting the Scientific Thinking and Inquiry of Toddlers and Preschoolers Through Play (2-5)

<https://scienceinprek.si.edu/sites/default/files/NAEYC%20Science%20Article%20%281%29.pdf>

This article offers ideas for how teachers can create opportunities for young children to expand their understandings of scientific concepts and science inquiry during play.

Teaching Science During the Early Childhood Years (3-9)

http://ngl.cengage.com/assets/downloads/ngsci_pro0000000028/am_trundle_teach_sci_early_child_scl2-0429a.pdf

This article provides evidence to support the point that science education in early childhood is of great importance to many aspects of a child's development.

Unlocking Learning: Science as a Lever for English Learner Equity (5-9)

<http://west.edtrust.org/resource/unlocking-learning-science-lever-english-learner-equity/>

Based on in-depth site visits and featuring real world examples of high-performing schools, high-quality professional development, and innovative classroom practices, this January 2017 report lays out a blueprint for increasing access and achievement in science for young English learners. Key takeaways of the report include:

- *Research shows that weaving together science and language development can increase students' academic performance in reading, writing, and science simultaneously.*
- *Some promising practices are resulting in achievement levels that are double and even triple the state average for English learners who met or exceeded proficiency.*

The report concludes with district-level and state-level recommendations, along with a series of questions for community stakeholders to ask in their advocacy for closing English learner achievement gaps in science.

Using Hands-on Science to Build Amazing Literature Connections (3-6)

<http://home.edweb.net/using-hands-science-build-amazing-literature-connections/>

This archived webinar describes how to connect science through children's literature. NOTE: Free registration with the edWeb community is required to view these materials.

Young Learners at Natural History Museums (3-9)

http://www.southernearlychildhood.org/upload/pdf/Young_Learners_at_Natural_History_Museums_Leah_M_Melber_Vol_36_No_1.pdf

This article offers insights for ways in which to meet early childhood science standards using museum visits

AUDIOVISUAL SOURCES

Children Explain Why Their Nature Explore Outdoor Learning Space is Important (3-6)

https://www.youtube.com/watch?v=grcCUtFaM_s *The title says it all!*

Curious Minds: Incorporating STEM into Early Childhood Classrooms (0-9)

This webinar explores effective strategies for engaging young children through science, technology, engineering and math in preschool and early elementary classrooms. Did you know that by ten months of age, babies can distinguish a set of 2 items from a set of 3, or that providing young children with high-quality STEM experiences early on can provide a foundation for later success in reading? Watch to learn more about how STEM may be incorporated into ECE settings.

Essential Science for Teachers: Earth and Space Science

<https://www.learner.org/resources/series195.html> (5-9)

This is a video course for K-6 teachers on earth and space science.

Essential Science for Teachers: Life Science <https://www.learner.org/resources/series179.html> (5-9)

Life Science consists of eight one-hour video programs accompanied by print and Web materials that provide in-class activities and homework explorations. Real-world examples, demonstrations, animations, still graphics, and interviews with scientists compose content segments that are intertwined with in-depth interviews with children that uncover their ideas about the topic at hand. Each program also features an elementary school teacher and his or her students exploring the topic using exemplary science curricula.

Every Day Fun with Engineering and Technology (0-5)

<http://talkingisteaching.org/resources/lets-talk-about-stem-video-engineering>

Watch the video or download the handout to see fun activities designed to support young children's growing knowledge of engineering and technology from birth to five. Both are available in English and Spanish.

Every Day Fun with Science (0-5)

<http://talkingisteaching.org/resources/lets-talk-about-stem-video-science>

Watch the video or download the handout to see fun activities designed to support young children's growing knowledge of science from birth to five. Both are available in English and Spanish.

Foundations of Learning: Building STEM Skills (3-9)

<http://www.communityplaythings.com/resources/videos/building-stem-skills>

This educational 3-minute video explains why every school that is serious about STEM education needs to have a strong block play component in their curriculum.

Hypothesizing About Bugs <https://www.teachingchannel.org/videos/pre-k-science-lesson> (3-5)

This clip shows how to support preschoolers to construct and test hypotheses about bugs.

An Investigation <https://www.youtube.com/watch?v=2zjRHZGE64E> (2-3)

A two-year-old investigates the properties of a magnetic ball and a copper tube while her older brother looks on. Is curiosity an emotion? Is it the pleasurable feeling inherent in making sense of the world -- of discovering our own wonderful ideas? This little one makes a good case for it... and makes us wonder: What kind of school will support her to keep the fire in her drive to learn burning brightly?

Let's Talk About STEM Video Series (0-5)

<https://www.zerotothree.org/resources/series/let-s-talk-about-stem-video-series>

Young children begin to learn about early science, technology, engineering and math (STEM) through play and everyday routines, activities and interactions. These videos, illustrating the development of STEM skills in the first five years of life, are essential to understanding and highlighting the development of STEM skills. Each is available in both English and Spanish.

Outdoor Learning with Vermont's Teacher of the Year (6-7)

<http://www.wcax.com/story/30336587/outdoor-learning-with-vermonts-teacher-of-the-year>

Listen and watch to learn how Vermont's teacher of the year gets young children engaged in outdoor play and nature.

Reasoning About Garden Observations <https://www.teachingchannel.org/videos/pre-k-lesson-observation-skills> (3-5)

This clip highlights strategies for developing observation and reasoning skills.

Science and Nature: A Natural Connection in a Child's World of Wonder (3-6)

<http://home.edweb.net/science-and-nature-a-natural-connection-in-a-childs-world-of-wonder/>

- View this archived webinar to learn about exciting take-home, easy-to-use, easy-to-make activities that include scientist of the week, mystery box, storytelling tool box and much, much more! NOTE: Free registration with the edWeb community is required to view these materials.

Science Ideas for Teachers <http://view.vzaar.com/4772941/download> (3-5)

This video highlights ways to teach preschoolers science concepts using nature and play.

Science Videos https://www.teachingchannel.org/videos?page=1&categories=subjects_science&load=1 (7-9)

The Teaching Channel website has 150+ video clips organized by grade, many of which build capability in multiple domains (e.g., Building Scientific Ideas with Interactive Read-Alouds).

Want Scientifically Literate Children? Get Out of Their Way (0-9)

<https://www.youtube.com/watch?v=AIEJpVIZu0&feature=youtu.be>

Neil deGrasse Tyson shares his advice on ways to get children interested in science.

ONLINE SOURCES

Audubon Vermont Education Programs <http://vt.audubon.org/audubon-education-programs-1> (3-6)

This group provides young children with fun, hands-on learning experiences that honor a child's natural curiosity, physical ability and desire to play. Their seasonal programs help to develop a child's ability to pose questions about nature, to participate successfully in cooperative play, and to develop motor skills through games and role playing.

Breathe Life into Learning with Engaging Academics (5-9)

<https://www.responsiveclassroom.org/breathe-life-into-learning-with-engaging-academics/>

This article highlights six practical and effective way to support engaging academics.

Early Childhood Building Blocks: Turning Curiosity into Scientific Inquiry (3-9)

<http://earlychildhoodscience.pbworks.com/w/file/fetch/72349637/turning%20curiosity%20into%20scientific%20inquiry.pdf>

This resource can help start children on a journey from curiosity to inquiry by fueling their curiosity—by asking purposeful questions, supplying hands-on tools for exploration and discovery, dedicating blocks of time for exploration, and creating an environment that encourages observation, demonstration, and explanation—and then stepping aside a bit so inquiry can freely develop.

ECHO Science Center and Lake Aquarium <http://echovermont.org/schools/teacher-resources.html> (0-8)

The Center offers a variety of resources and opportunities to Vermont educators, children and families.

ECO: Educating Children Outdoors <http://www.northbranchnaturecenter.org/eco.html> (3-9)

ECO is a standards-based nature immersion program that works in collaboration with public school teachers and their students. ECO's goal is to help children and their school to develop a lasting relation with the natural world and foster a sense of place and stewardship in our local Vermont communities.

Engineering is Elementary (EIE) (5-9)

<https://eie.org/>

Engineering is Elementary supports educators and children with curricula and professional development that develop engineering literacy. It offers videos, research, and supports for K-12 educators.

Infants and Toddlers: Young Scientists Exploring the World Around Them: An Annotated Bibliography for Course Developers, Daryl B. Greenfield, Ph.D., University of Miami (0-3)
https://earlyeducatorcentral.acf.hhs.gov/sites/default/files/public/resources/Infants%20and%20Toddler%20Young%20Scientists%20Exploring%20the%20World%20Around%20Them_0.pdf

This compilation features research and evidence sources to support both why and how we should promote opportunities for infants and toddlers to be scientists in their cribs.

Learning Science Through Inquiry <https://www.learner.org/resources/series129.html> (5-8)

This video workshop shows inquiry teaching and learning in action, with real teachers and students in real classrooms.

Making Sense of Science Teacher Resources (5-9)

<http://we-mss.weebly.com/teacher-resources.html>

The content and pedagogical resources at this site may be downloaded for use in classrooms or with colleagues.

NASA Education for Grades K-4 <https://www.nasa.gov/audience/foreducators/k-4/index.html> (5-9)

This website offers resource for activities about space, aeronautics, and weather and many free resources for teachers.

Science (5-9)

<http://education.vermont.gov/student-learning/content-areas/science>

As part of the Vermont Agency of Education's commitment to supporting schools in the delivery of effective K-12 science instructional programs, this site provides teachers, administrators, expanded learning providers, higher education faculty, parents and community members with a broad range of resources.

Science <https://www.learner.org/resources/discipline-science.html> (5-9)

This section of the Annenberg Learner website offers teacher resources and professional development offerings in science. Search the website to find companion videos and lesson plans.

Science <http://www.pbs.org/parents/education/science/> (0-8)

This section of the PBS Parents website offers ideas for supporting scientific learning, organized by the age of the child.

Science and Math: Resources from the Educational Equity Center (3-9)

<http://www.edequity.org/programs/science-and-math-programs/>

The resources and practices shared through this site are designed to promote math skills for young boys and girls who are culturally, linguistically and contextually diverse.

SciMath-DLL Professional Development <http://scimathdll.com> (3-9)

This Rutgers-sponsored website has a variety of resources for teaching about aspects of STEM. For example, workshop modules provide rich examples of best practice, include model lesson plans, and promote discussion around how to implement high-quality strategies in real settings. Modules cover a range of important topics in early childhood STEM and infuse ideas and tips for working with dual language learners throughout.

Shelburne Farms <http://shelburnefarms.org/our-work/for-educators-schools/professional-development-for-educators>

(3-9) *Shelburne Farms offers a variety of resources and opportunities to Vermont educators, children and families.*

Stand Up for STEM <http://www.tolerance.org/lesson/stand-stem> (7-9)

This series of lessons from Teaching Tolerance explores the work of STEM professionals, examines the underrepresentation of women and people of color in STEM and considers ways to encourage diversity in these fields.

STEM for Early Learners (2-5)

https://pdg.grads360.org/?utm_content=&utm_medium=email&utm_name=&utm_source=govdelivery&utm_term=#program/stem-in-early-childhood

This series of free webinars, research readings, and practical application activities was designed to enhance professionals' understanding and confidence in supporting children's intellectual learning. The eleven sequential modules offers research, practical application for classroom and home and provides examples of experiences that build scientific, technology, engineering, and mathematical learning for older toddlers and preschool children.

STEM from the START <http://stemfromthestart.org/> (3-7)

This online set of curriculum resources for teaching STEM content blends animated adventures with guided activities. The content is aligned with the Next Generation Science Standards.

STEM in Early Learning (2-5)

https://pdg.grads360.org/?utm_content=&utm_medium=email&utm_name=&utm_source=govdelivery&utm_term=#program/stem-in-early-childhood

This series consists of 11 video-based online modules feature 1) webinar presentations from national experts; 2) suggested research readings; and 3) practical application activities. The series was designed to enhance early learning professionals' confidence in supporting young children's higher-order thinking and learning related to science, technology, engineering, and math.

STEM Sprouts Science, Technology, Engineering, & Math Teaching Guide (3-5)

<http://www.bostonchildrensmuseum.org/sites/default/files/pdfs/STEMGuide.pdf>

The STEM Sprouts Teaching Kit is the product of a collaboration between National Grid, Boston Children's Museum, and WGBH. The goal of this curriculum is to assist preschool educators in focusing and refining the naturally inquisitive behaviors of three to five-year-olds on science, technology, engineering, and math (STEM).

Successful STEM Education (5-9)

<https://successfulstemeducation.org/>

This site provides information, events, and resources that highlight promising practices and tools in support of effective K-12 STEM education in schools and programs.

Teaching Science to Students with Learning Disabilities (5-9)

<http://www.nsta.org/publications/news/story.aspx?id=51706>

This online article outlines basic educational principles that support the unique learning needs of students with learning disabilities. Each principle is accompanied by examples of how a science instructor might put that principle into practice.

Unlocking Learning: Science as a Lever for English Learner Equity (5-9)

<https://west.edtrust.org/resource/unlocking-learning-science-lever-english-learner-equity/>

Based on in-depth site visits and featuring real world examples of high-performing schools, high-quality professional development, and innovative classroom practices, the 2017 Unlocking Learning report lays out a blueprint for increasing access and achievement in science young English learners. This URL provides access to the report, an annotated bibliography, recommendations, and a family advocacy handout in Spanish.

Vermont Institute of Natural Sciences <http://www.vinsweb.org/> (0-9)

The Institute offers a variety of resources and opportunities to Vermont educators, children and families.

Young Learners at Natural History Museums (3-9)

http://www.southernearlyphildhood.org/upload/pdf/Young_Learners_at_Natural_History_Museums_Leah_M_Melber_Vol_36_No_1.pdf

This article offers insights for ways in which to meet early childhood science standards using museum visits.